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Revisiting corporate governance and financial risk-taking

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Abstract

Corporate governance attributes have varying effects on risk taking when variables are examined separately. We study the effects of a large range of corporate governance attributes on risk taking using a comprehensive US sample. Our findings confirm that although there are certain characteristics that drive this positive effect such as compensation structure, there are those which have the opposite effect such as board-level attributes. Our paper contributes to the broader literature on the relationship between corporate governance and risk in financial institutions, which are often overlooked in traditional studies. We shed light on the importance of studying corporate governance at a granular level rather than using a single index. The findings offer insights to regulators in determining suitable corporate governance frameworks to ensure the protection of investors rights in financial institutions.

KEYWORDS

corporate governance, financial institutions, financial risk taking, principal component analysis, risk measurements, structural equation modelling

1 | INTRODUCTION

Corporate Governance (CG) in financial institutions is an under-researched area (Laeven & Levine, 2009; Sheedy & Griffin, 2018; Srivastav & Hagendorff, 2016); we study the effects of corporate governance on risk taking of financial institutions, and identify characteristics (variables) that have the most significant effect on risk taking. In doing so, we derive principles of CG for effective internal risk management and protection of shareholder rights.

Existing literature includes several papers that study the impact of CG on risk-taking. However, most of these papers use indices (such as Anginer et al. (2018), Ferreira and Laux (2007), John et al. (2008) and Sheikh (2019)). Other papers include only specific characteristics of CG (such as Cain and McKeon (2016), Deyoung et al. (2013), Erkens et al. (2012), Lu and Wang (2018) and Wu (2016)). In addition, most existing papers examine the effect of CG on risk taking in non-financial firms (Ferreira & Laux, 2007; John et al., 2008; Nakano & Nguyen, 2012; Sheikh, 2019). Other studies focus on banks only and exclude non-bank financial institutions (Anginer et al., 2018; Berger et al., 2016; Laeven & Levine, 2009; Saunders et al., 1990).

Similar to Kim and Lu (2011), we believe it is essential to study how different governance characteristics work together in mitigating agency costs rather than studying each characteristic individually. In addition, there are major concerns about the validity of Governance Indices (GI) partly because CG is an abstract concept and no index is able to fully capture its underlying complexity (Sheikh, 2019) and single indices suffer from omitted variable bias (Black et al., 2017).

In previous studies, CG was studied using indices that included many variables. These papers used a kitchen-sink approach to study the effect of most of the plausible governance indicators on risk. In this paper, we argue

that CG is a complex issue with different characteristics and cannot be studied by a single index. Therefore, granular analysis is the most suitable approach.

As an alternative of GI, we use PCA as a replacement for indexing. The motive of employing PCA is that previous studies have relied on using one index that shows the overall effect of CG (Aggarwal et al., 2009; Almustafa et al., 2023; Anginer et al., 2018; Bebchuk et al., 2009; Gompers et al., 2003). However, prior literature suggests that not all CG characteristics have the same impact on risk; while some positively affect risk taking, other characteristics have a negative effect. Thus, PCA is used as a replacement for one governance index and as an unbiased method of grouping different dimensions of CG with similar variances to capture their different effects. PCA has several advantages over indices which are: First, PCA shows the individual effect of each variable within each group, and accounts for different loadings of variables in one group. Second, it accounts for multicollinearity that exists in CG variables by converting correlated variables into uncorrelated factors (Jolliffe, 2002). Third, it allows for individual interpretation of each variable by showing factor loadings and signs for each individual variable within each factor, unlike indices which only show the total impact of each group (Beekes et al., 2010; Bhat, 2008; Jolliffe, 2002).

Studies that have used PCA to examine CG variables include Beekes et al. (2010), Bhat (2008), Black et al. (2017) and Enache and Hussainey (2020). However, none of these studies has been conducted in financial institutions, and none has used PCA to study CG in the context of risk taking. Also, we focus on financial institutions which suffer from excessive risk taking.

Therefore, this study contributes to the finance literature in several ways. First, we examine a whole range of CG characteristics in a single model using PCA. Second, in contrast to most existing studies, our study covers all financial institutions including banks and non-banks. Also, to the best of our knowledge, this is the first study that uses PCA and structural equation modelling (SEM) in studying the effect of CG on risk taking.

2 | LITERATURE REVIEW

2.1 | Agency theory

This study adopts the agency theory. The theory proposes that there is an agency loss arising from the separation of ownership and management, where in a corporation, the principals are the owners while the agents are the managers. According to the theory, the managers of a corporation will not aim at maximizing shareholders' values unless governed in a way to protect the interests of the shareholders (Jensen & Meckling, 1976). CG should address the agency problem by ensuring that managers do not seek their own interests at the expense of shareholders' interests and that they do not invest in unappealing projects (Shleifer & Vishny, 1997).

To further understand the difference between what shareholders and managers want, Ricciardi (2010) explains that the interest of shareholders is to maximize stock prices in the long run, while the managers aim at increasing their personal wealth in the period of their tenancy. This means that managers will focus on short-term profit maximization and low risk projects that are not necessarily addressed to maximize the wealth of shareholders in the long run. Therefore, corporations need to be governed and managers need to be monitored in order to align their interests with shareholders' interests. This can be done by regulating the board and management of a corporation by certain measures including ensuring the independence of the board and aligning executive compensation to firm performance (Todd, 2010).

Therefore, this study adopts the agency theory because it proposes that shareholders are risk bearers who bear the risk of decisions taken by managers (Fama & Jensen, 1983; Williamson, 1988). CG ensures that such decisions taken by managers are in the shareholders' favour. However, some studies show that high shareholder protection leads to excessive risk taking. Other studies argue that a weaker investor regime with the existence of dominant shareholders works as an effective monitoring tool to decrease managerial conservatism and induces managers to seek the interests of shareholders (Jensen & Meckling, 1976; Shleifer & Vishny, 1986).

2.2 | Corporate governance in financial institutions

The focus of corporate governance on financial institutions mainly stems from their importance in the market. In the financial sector, having strong CG practices is a key factor in ensuring financial stability (Mallin et al., 2005), because the failure of the financial market eventually reaches the global economy. Also, Almaqtari et al. (2020) find that country-level CG has a significant impact on the profitability of banks. In addition, the financial sector suffers from excessive risk-taking which might cause negative externalities and systemic risk. These are the reasons why the financial sector is more regulated than non-financial sectors (Flannery, 1998). Also, the green paper by the European Commission showed that the risk management function of the financial sector led to excessive risk-taking and short-termism. The report also states that one of the most profound failures during the financial crisis was the

failure of risk governance in the financial sector (European Commission, 2010).

Anginer et al. (2018) perform a comparative study between banks and non-financial firms in the United States (US) and find that banks are greater risk takers. Moreover, Erkens et al. (2012) find that more board independence and higher institutional ownership are related to worse stock returns in financial institutions during the crisis.

Despite the importance of financial institutions, existing studies that examine the effect of CG on risk taking either focus on non-financial institutions (Ferreira & Laux, 2007; John et al., 2008; Nakano & Nguyen, 2012; Sheikh, 2019), or on banks and exclude non-bank financial institutions (Anginer et al., 2018; Berger et al., 2016; Laeven & Levine, 2009; Saunders et al., 1990). Also, in a study by Almustafa et al. (2023) which examines the effect of CG on risk taking in non-financial firms, the authors concur that one of directions for future research is to study the relationship in a different industry.

Therefore, in our study, we include all institutions classified as financial according to the Global Industry Classification System (GICS), which includes banks, insurance and diversified financial companies.

2.3 | Corporate governance and risk taking

Current studies that examine the effect of CG on risk taking either use a GI to represent CG as a whole or focus on specific characteristics of CG. Studies that have used the GI developed by Gompers et al. (2003) have found that CG with better investor protection leads to higher risk (Ferreira & Laux, 2007; John et al., 2008; Sheikh, 2019). Similarly, Anginer et al. (2018) use Aggarwal et al. (2009) GI and show a significant positive relationship between shareholder-friendly CG and risk taking. Furthermore, a study conducted by Laeven and Levine (2009) shows a positive relationship between risk taking in banks and strong shareholder protection. In emerging markets, Almustafa et al. (2023) found that countries with higher score of governance index incentivize non-financial firms to take more risk.

> **Hypothesis 1.** Shareholder friendly corporate governance has a positive effect on risk taking in financial institutions.

However, many studies question the validity of using indices to represent CG which is very complex and has an abstract concept (Black et al., 2017; Sheikh, 2019). Therefore, we list below the current work done on examining different characteristics of CG on risk taking, including board structure, shareholders rights, ownership structure, and compensation elements.

Jebran and Chen (2020) focus on how CG can help firms to survive during COVID-19 crisis, they show that independent risk management committees, institutional ownership, board independence, and family ownership are some of the essential and effective governance mechanisms compared to other governance attributes during COVID-19 crisis.

CG codes highlight the important role of the board. Many codes and guidelines assign the responsibility of monitoring and ensuring the effectiveness of risk management to the board (Basel Committee on Banking Supervision, 2015; Financial Reporting Council, 2018; OECD, 2015). Empirically, Anginer et al. (2018) show that a governance index with many CG characteristics including board independence, board size, and committees' independence, is associated with excessive risk taking. Likewise, Anginer et al. (2016) investigate whether shareholder friendly CG in banks is related to bank capitalization strategies, basing their study on the hypothesis that banks with shareholder friendly CG adopt risky capitalization strategies in order to maximize shareholder value. They include three CG mechanisms that they believe are related to bank governance: board independence, board size, and anti-takeover provisions. Their results show that banks with shareholder friendly CG have lower capitalization suggesting more risk taking policies. Lu and Wang (2018) study the effect of board independence on corporate innovation and managerial risk taking and find that independent boards tend to increase equity-based compensation leading to more managerial risk taking. However, Wu (2016) find that board independence is positively related to bankruptcy, but negatively related in firms with more knowledgeable boards.

> **Hypothesis 2.** Board characteristics including independence have a positive effect on risk taking.

As for other board characteristics including board size, both Pathan (2009) and Wu (2016) find that smaller boards lead to more risk taking, with both studies covering different sectors. Tosun et al. (2021) examine board exposure to prior disasters. Pathan (2009) studies US banks over the period 1997–2004 using different risk measurements including total risk, idiosyncratic risk, and systematic risk. While Wu (2016) studies non-financial firms and finds that board size, gender diversity, and CEO tenure are negatively related to bankruptcy risk. Their results suggest that the existence of females on the Board motivates risk aversion behaviour. Also, Saeed et al. (2019) find that

family ownership negatively moderates the impact of female executives on risk-taking in high-tech firms.

> **Hypothesis 3.** Board characteristics including Board size and gender diversity have a negative effect on risk taking.

Furthermore, researchers emphasize the importance of the attributes of the CEO in influencing corporate decisions. In behavioural finance, managers with more power are believed to take more risk (Ricciardi, 2010). Adams et al. (2005) and Sheikh (2019) find that CEO power, proxied by several variables including CEO duality, is positively associated with risk taking. In addition, Switzer et al. (2018) find that CEO duality is positively related to default probabilities. However, Berger et al. (2016) find that failed banks during the financial crisis had less CEO duality.

> **Hypothesis 4.** CEO Duality has a positive effect on risk taking.

Another important attribute of CG is shareholders rights. CG with better shareholders' rights protection is believed to be associated with aggressive risk policies (Ferreira & Laux, 2007; John et al., 2008). Mishra (2011) finds that the presence of a dominant shareholder is associated with lower risk, but the voting rights of multiple large shareholders are associated with higher risk. In addition, Kieschnick and Moussawi (2018) find that firms with dual classes tend to lower their cost of financing by choosing debt over equity, These findings imply that firms with unequal voting rights are related to less risk taking.

> **Hypothesis 5.** Dual classes with unequal voting rights has a negative effect on risk taking.

In addition, ownership is an important characteristic of CG. Large and dominant owners with monitoring powers help in reducing the discretion enjoyed by managers in a diluted ownership (Jensen & Meckling, 1976; John et al., 2008; Shleifer & Vishny, 1986, 1997). Laeven and Levine (2009) find that strong cash flow rights of large shareholders are related to higher risk taking. However, Shleifer and Vishny (1997) argue that the cost of having large shareholders is that they bear excessive risk. Also, the OECD (2015) states that the presence of a controlling shareholder may lead to the abuse of other shareholders.

Also, Erkens et al. (2012) find that institutional ownership is related to worse stock returns during the financial crisis. Also, Hutchinson et al. (2015) find a positive relationship between the existence of institutional shareholders and risk taking. However, Nakano and Nguyen (2012) and Switzer et al. (2018) find that institutional ownership is associated with lower risk. Also, a review done by Jebran and Chen (2020) illustrates that institutional ownership is one of the essential and effective CG mechanism compared to others during the COVID-19 crisis.

> **Hypothesis 6.** Insider and Institutional shareholdings have a positive effect on risk taking.

The final and essential characteristic of CG is the compensation elements. The CG Principles by the Basel Committee on Banking Supervision (2015) require banks to have a compensation structure that supports sound CG and risk management. Researchers show that managerial risk aversion can be addressed by their ownership in the company and the compensation structure (Laeven & Levine, 2009; Saunders et al., 1990). As a result, the decision makers will share risk bearing with investors (Fama & Jensen, 1983). Edmans et al. (2017) state that all elements of compensation have an effect on risk taking, especially for firms close to bankruptcy.

Existing studies show that stocks and options in CEO and executives' compensations positively and significantly affect risk taking, where receiving more stock awards is associated with higher risk (Anginer et al., 2018; Berger et al., 2016; Kim & Lu, 2011; Nakano & Nguyen, 2012; Saunders et al., 1990). Jensen and Meckling (1976) suggest cash compensation as a proxy for CEO and executive wealth which has rarely been examined in previous studies. This type of compensation is believed to be related to risk taking because, in the event of firm failure, the CEO will be deprived of such a benefit (Cassell et al., 2012; Jensen & Meckling, 1976). The cash compensation calculated as the sum of the salary and bonus is used by Cassell et al. (2012) and Guay (1999) as a proxy for CEO wealth instead of the stock-based compensation.

As for directors' compensation, Ertugrul and Hegde (2008) find that the percentage of stocks and options in relation to the total compensation of outside directors is associated with lower yield spreads. Dah and Frye (2017) argue that overcompensated directors might deviate from fulfilling shareholders' interests.

> **Hypothesis 7.** Compensation elements including stock and option awards, cash compensation, and CPS have a positive effect on risk taking.

Other elements of compensation that are believed to be related to risk taking include the deferred compensation; where more CEO deferred compensation leads to conservative investment decisions and less risk taking

(Cassell et al., 2012; Edmans & Liu, 2011; Jensen & Meckling, 1976; Srivastav & Hagendorff, 2016). Furthermore, Bebchuk et al. (2011) state that CEO Pay Slice (CPS) reflects the CEO's role and power in the top management team. Sheikh (2019) includes CPS in the CEO power index, which is found to have a positive association with risk taking.

The empirical studies mentioned above show that not all CG characteristics have the same effect on risk. This highlights the necessity of using granular analysis to studying CG. IT also confirms the concerns raised against the GI, where these indices do not address the complexity of CG (Black et al., 2017; Sheikh, 2019). Therefore, we use PCA as a replacement for a single GI to create factors of different characteristics of CG with similar variances. PCA has an advantage over GI because it shows the individual effect of each variable within each group. It also accounts for different loadings of variables in one group. To conclude, PCA has been used by studies to represent CG (Beekes et al., 2010; Bhat, 2008; Black et al., 2017; Elmagrhi et al., 2020; Enache & Hussainey, 2020). However, none of these studies has been conducted in financial institutions, and none has used PCA to study CG in the context of risk taking.

Hypothesis 8. Deferred and non-equity incentives have a negative effect on risk taking.

3 | DATA AND VARIABLE CONSTRUCTION

3.1 | Datasets

We explore a sample that covers the period from 2011 to 2018 including all financial institutions that are publicly listed in the US. The selection of financial institutions is based on GICS, which includes banks, insurance and diversified financial companies. We obtained the CG, accounting, and market data from Bloomberg. The analysis includes 3116 institution-year observations.

3.2 | Risk measurements

We incorporate five measurements of risk taking that have been mostly used in prior literature. Table B1 provides the prior literature on measuring risk taking. Those measurements represent two classifications of risk, standalone risk (specific risk) and market risk. This enables us to test the effect of CG on risk taking on two levels: a firm's level and a firm's sensitivity to the market's risk.

We use two variables for market risk. The first one is the *Stock Return Volatility* which is frequently used in the literature (Cain & McKeon, 2016; Christy et al., 2013; Deyoung et al., 2013; Erkens et al., 2012; Ferris et al., 2017; Guay, 1999; Hutchinson et al., 2015; Nakano & Nguyen, 2012; Saunders et al., 1990; Sheikh, 2019). In our study, the *Stock Return Volatility* is calculated as the annualized standard deviation of daily stock returns. The second is *Idiosyncratic Risk* measured as the standard deviation of the residuals derived from regressing daily stock return on market return in each year (Deyoung et al., 2013; Islam et al., 2019; Wu, 2016; Wu et al., 2020). We compute *Idiosyncratic Risk* as the standard deviation of the residuals derived from the following model:

$$R_{id} = \beta_0 + \beta_1 R_{md} + \varepsilon_{id}, \tag{1}$$

where R_{id} is the stock return of the firm i in the day d, R_{md} is the stock return of the market m in the day d, and ε is the residuals. To calculate the standard deviation of the residuals, the *Idiosyncratic Risk* is calculated as:

$$\text{Idiosyncratic Risk} = \sqrt{\frac{\sum (R_{id} - \bar{R}_{id})^2}{n-1}}. \tag{2}$$

Next, we use three variables for stand-alone risk. The *Z*-score measures the distance to insolvency and is used in many studies to test the stability of a firm (Akbar et al., 2017; Alhalabi et al., 2020; Berger et al., 2016; Hutchinson et al., 2015; Laeven & Levine, 2009). A higher score indicates more stability and a lower probability of insolvency. We calculate *Z*-score as follows:

$$Z_{it} = \frac{\text{ROA}_{it} + \frac{E}{A_{it}}}{\sigma \text{ROA}_{it}}, \tag{3}$$

where Z_{it} is *Z*-score for the institutions i year t, *ROA* is Return on Assets, E/A is equity to assets ratio, and σROA is the standard deviation of Return on Assets.

In addition, we include two more risk measurements for stand-alone risk, which are return on assets volatility (*ROAV*) and *Leverage*, calculated as the standard deviation of the returns on assets and the ratio of total debt to total assets respectively (Anginer et al., 2018; Ferris et al., 2017; Laeven & Levine, 2009; Mishra, 2011; Nakano & Nguyen, 2012).

3.3 | Corporate governance variables

All CG in this study were obtained from the Bloomberg database. Initially, there were 72 variables, and then

variables with very little or no data availability were omitted. In addition, variables in which almost all institutions have the same value were omitted (e.g., almost all committees were fully independent, and almost all institutions had shareholders authorized poison pill). The final set of variables is 24 CG variables, these 24 variables cover almost all CG aspects including the board's characteristics (Table C1).

The first set of CG variables are related to the board's characteristics, they include board size, board independence, board meetings, board attendance, board average age, board tenure, CEO duality, and gender diversity which captures the female existence in the board. The second set of variables represent the ownership structure of the firm and includes institutional and insider Ownership. The variable Unequal Voting Rights (UVR) represents the shareholder's rights and indicates the equality of the voting rights across different classes of shares. The last set of variables related to the compensation includes variables that have not received much attention empirically but are theoretically believed to be related to risk taking. The variable Board Stocks represents the board's compensation, while Compensation Advisor, CEO Stocks, Executives Stocks, CEO Options, Executives Options, CEO Deferred, Executives Deferred, CEO non-equity incentives, and Executives non-equity incentives represent the CEO and executives compensation. Also, CEO cash and executives cash represent the wealth available to executives that will enable them to diversify their investments. Finally, CPS is Bebchuk et al. (2011) CEO Pay Slice calculated as the ratio of the CEO's total compensation to the executives' total compensation. Details of all variables and their definitions are represented in Table A1.

3.4 | Corporate governance factors

Instead of the commonly used GI, we use principal component analysis (PCA) as a method of grouping different dimensions of CG with similar variances to capture their different effects. Dolan et al. (1999) state that "PCA is often aimed at data description, or reduction"; thus, we use PCA as a reduction tool of the large number of variables.

In this study, the PCA is used to identify factors that capture CG different dimensions and creates groups of CG variables that are associated with each other. In addition, PCA converts correlated variables into uncorrelated factors, which accounts for the multicollinearity that exists in CG variables (Jolliffe, 2002). Another important benefit of using PCA as a replacement for indices is that it allows for individual interpretation of each variable within each factor, unlike the traditionally used indices which only show the total impact of each group. It allows for individual interpretation by showing factor loadings and signs for each individual variable within each factor (Beekes et al., 2010; Bhat, 2008; Jolliffe, 2002). Studies that have used PCA to examine CG variables include Beekes et al. (2010), Bhat (2008), Black et al. (2017) and Enache and Hussainey (2020). Similarly, Salehi et al. (2022) use explanatory factor analysis to study the effect of several CG variables on cost of equity. However, none of these studies has been conducted in financial institutions, and none has used PCA to study CG in the context of risk taking. Also, we focus on financial institutions which suffer from excessive risk taking.

We follow prior literature in constructing the factors (Andreou et al., 2016; Dey, 2008; Jolliffe, 2002; Larcker et al., 2007). We use eigenvalues and the scree plot to determine the suitable number of factors; any factor with an eigenvalue that is greater than one is retained, and to confirm the selection we use the scree plot to identify factors that are plotted before the break of large and low eigenvalues. The selection process resulted in seven factors that accounted for 63.25% of the total variance. Then, we rotate the factors using oblique rotation to produce factors that are more interpretable. Because the orthogonal rotation resulted in cross-loadings (where some of the variables were significantly loaded on more than one factor), we perform an oblique rotation as in Larcker et al. (2007). Finally, in each factor we retain variables that are significantly loaded (the absolute value of the component loading exceeds 0.4). The factors and factor loadings resulting from the PCA are reported in Table 1. We refer to them as the PCA governance factors hereinafter.[i]

In addition, an additional analysis is performed using a governance score developed by the Institutional Shareholder Services (ISS) that was used to develop the governance index by Aggarwal et al. (2009). This index was also used by Anginer et al. (2018) to study the effect of CG on risk taking. Then, the results are compared to their sub-scores (Board, Shareholders, Audit, and Compensation). Both analyses confirm the idea that CG characteristics are better studied in detail rather than as a whole; where the findings show that there are specific characteristics including compensation structures and auditing practices that drive the positive relationship between CG and risk, while other variables, including Board characteristics, have a negative impact.

3.5 | Control variables

We use various control variables drawn from literature for the linear regression models. We analysed 24 papers that examined CG and risk-taking to find the commonly used control variables. The most common control variables are

TABLE 1 Principal component analysis.

Factor	Significant components	Loading	Cumulative variance explained (%)
Gov1	CEO cash	0.861	22.47
	Executive cash	0.807	
	Executive stocks	0.780	
	CEO stocks	0.762	
	Institutional ownership	0.671	
	Board stocks	0.668	
	Compensation advisor	0.442	
	Insider ownership	−0.438	
Gov2	Board independence	0.661	32.89
	Board meetings	0.602	
	CEO duality	−0.449	
	Unequal voting rights	−0.424	
	Board duration	0.395	
Gov3	Executive deferred	0.937	40.29
	CEO deferred	0.937	
Gov4	Executive options	0.985	47.61
	CEO options	0.975	
Gov5	CEO non-equity incentives	0.905	53.75
	Executive non-equity incentives	0.898	
Gov6	CPS	0.823	58.78
	Gender diversity	−0.562	
Gov7	Board meeting attendance	−0.770	63.25
	Board size	0.406	
	Board average age	0.406	

Note: The table reports the factors resulting from the principal component analysis (PCA), the components loaded in each factor, the component loadings and the cumulative variance explained. All factors with an eigenvalue greater than one are retained, and only components with an absolute value of loading exceeding 0.4 are reported. Components are reported in order of total variance explained.

the *Firm Size* (Anginer et al., 2018; Berger et al., 2016; Calomiris & Carlson, 2016; Ferris et al., 2017; Hutchinson et al., 2015; Lu & Wang, 2018; Salehi et al., 2022) and *Market to Book* ratio (Aebi et al., 2012; Anginer et al., 2018; Pan et al., 2017; Wu, 2016) to capture firm characteristics. *Return on Equity* and (Cain & McKeon, 2016; Christy et al., 2013; Ferreira & Laux, 2007) *Capital Ratio* (Aebi et al., 2012; Deyoung et al., 2013; Faleye & Krishnan, 2017) are also used to study the impact of CG on risk taking. Also, we include year fixed effects in the regressions. We have run the Hausman test and the results show that random effects do not apply to the data.

3.6 | Descriptive statistics

Table 2 provides the descriptive statistics for the CG, risk and control variables. We Winsorize all variables at 1% level on both sides of the distribution to account for outliers. We observe that the *Board Average Age* is about 62 years old, and the *Board Size* varies from a small board of one member only to a large board of 33 members in the US. We also notice that the existence of females on US boards is relatively low with 12% average *Gender Diversity*. Also, the average *Board Independence* in the US is approximately 77%. Finally, we observe that directors on boards can last in their positions for up to 4 years in the US.

4 | EMPIRICAL MODELS AND FINDINGS

We adopt Structural Equation Modelling (SEM) in examining the effect of the PCA governance factors on five risk measurements.

TABLE 2 Descriptive statistics

Variable	*N*	Min.	Max.	Mean	SD
ROAV	8721	0	194.58	4.46	21.19
Leverage	8336	0	156.82	17.97	25.67
Z-score	7017	−3.03	28.76	4.15	5.26
Stock return volatility	9311	0	191.97	4.70	20.28
Idiosyncratic risk	8630	0	116.27	3.31	12.42
Institutional ownership	8380	0	100	39.69	35.18
Insider ownership	8382	0	71	10.24	14.19
Board independence	5381	0	100	76.99	13.45
Board meetings	5280	0	57	10.11	4.84
Board attendance	5194	60	100	77.57	6.98
Gender diversity	5398	0	75	11.82	9.98
Board size	5398	1	33	9.97	3.20
Board average age	5371	39	81	62.23	4.59
Board duration	5128	1	4	2.02	1.00
CPS	4861	0	1	0.41	0.14
CEO duality	5392	0	1	0.42	0.49
CEO cash	4715	0	7.54	5.81	0.34
Executive cash	4910	4.70	8.02	6.27	0.37
CEO stocks	4875	0	7.95	3.72	2.85
CEO options	4877	0	7.89	1.43	2.43
CEO nonequity incentives	4867	0	7.15	3.15	2.88
CEO deferred	4847	0	7.40	1.85	2.49
Executive stocks	5001	0	8.52	4.27	2.88
Executive options	4998	0	7.97	1.75	2.66
Executive non-equity incentives	5004	0	7.76	3.59	3.01
Executive deferred	4987	0	7.45	2.26	2.68
Board stock	5054	0	107.02	26.18	25.18
Compensation advisor	5301	0	1	0.57	0.49
Unequal voting rights	5387	0	1	0.07	0.25
Firm size	8376	0.30	12.52	9.02	1.15
ROE	7528	−101.05	66.45	5.42	19.37
M to B	7760	−5.18	13.83	1.36	1.90
Capital ratio	8376	−13.01	1	0.057	1.35

In our SEM, the latent variables *LV StandAlone Risk* and *LV Market Risk* represent the level of stand-alone risk and market risk respectively. In the measurement model, the two latent variables are measured by relating them to five observable variables (*Z-score*, *ROAV*, *Leverage*, *Idiosyncratic Risk*, *Stock Return Volatility*). The measurement models are specified as follows:

$$Z-\text{score}_{it} = \alpha_1 + \beta_1\, LV\ Standard\ Risk_{it} + \varepsilon 2_{i,t}, \quad (4)$$

$$ROA\,V_{i,t} = \alpha_2 + \beta_2\, LV\ Stand\ Alone\ Risk_{i,t} + \varepsilon 3_{i,t}, \quad (5)$$

$$Leverage_{i,t} = \alpha_3 + \beta_3\, LV\ Stand\ Alone\ Risk_{i,t} + \varepsilon 4_{i,t}, \quad (6)$$

$$Stock\ Return\ Volatility_{i,t} = \alpha_4 + \beta_4 LV\ Market\ Risk_{i,t} + \varepsilon 6_{i,t}, \quad (7)$$

$$Idiosyncratic\ Risk_{i,t} = \alpha_5 + \beta_5 LV\ Market\ Risk_{i,t} + \varepsilon 7_{i,t}, \quad (8)$$

where $LV\ Stand\ Alone\ Risk_{i,t}$ and $LV\ Market\ Risk_{i,t}$ are the latent variables that represent the stand-alone risk and market risk for the institution i in the year t. *Z*-score,

ROAV, Leverage, Idiosyncratic Risk and Stock Return Volatility are the observed variables. β_1, β_2 β_3, β_4 and β_5 are the factor loadings that show how the observed indicators determine scores of latent variables. ε represents the residuals.

In the structural model, the PCA governance factors are the exogenous variables and the predictors of the latent variables defined in the measurement model. The structural model is specified as the following system of equations:

$$\begin{aligned} LV\ StandAlone\ Risk_{i,t} = {} & \alpha_6 + \lambda_1 Gov1_{i,t-1} + \lambda_2 Gov2_{i,t-1} \\ & + \lambda_3 Gov3_{i,t-1} + \lambda_4 Gov4_{i,t-1} \\ & + \lambda_5 Gov5_{i,t-1} + \lambda_6 Gov6_{i,t-1} \\ & + \lambda_7 Gov7_{i,t-1} + \varepsilon 1_{i,t}, \end{aligned} \tag{9}$$

$$\begin{aligned} LV\ Market\ Risk_{i,t} = {} & \alpha_7 + \lambda_8 Gov1_{i,t-1} + \lambda_9 Gov2_{i,t-1} \\ & + \lambda_{10} Gov3_{i,t-1} + \lambda_{11} Gov4_{i,t-1} \\ & + \lambda_{12} Gov5_{i,t-1} + \lambda_{13} Gov6_{i,t-1} \\ & + \lambda_{14} Gov7_{i,t-1} + \varepsilon 5_{i,t}, \end{aligned} \tag{10}$$

where $Gov1_{i,t-1}$ to $Gov7_{i,t-1}$ are the PCA governance factors for the firm i in the year $t-1$. *LV StandAlone Risk* and *LV Market Risk* are the latent variables defined in the measurement model. λ_1 to λ_{14} are the regression coefficients. The exogenous variables were lagged by 1 year $(t-1)$ to account for the lagged effect of CG variables. We have run the model with current PCA governance factors and lagged it by one to 3 years. The results showed that one-year lagged factors were the most significant and had the best model fit. The lagging of the independent and control variables will contribute to reducing endogeneity. To further alleviate endogeneity, year and industry fixed effects are added to control for possibly omitted variables caused by the different preferences of risk by different industries (banks vs insurance companies) that can affect both risk and CG.

Table 3 and Figure 1 show the results of the SEM for the US sample. The model had a Root Mean Square Error of Approximation (RMSEA) with a P-value of 0.117, CFI value of 0.739, and NFI value of 0.735, which confirms the fitness of the model. Panel A reports the measurement model that shows the factor loadings of the risk measurements in the factor analysis. The variables *ROAV* and *Leverage* are positively loaded on the latent variable *LV StandAlone Risk*, while the *Z-score* is negatively loaded, which accounts for its adverse effect (higher *Z-score* indicates lower risk). Both *Idiosyncratic Risk* and *Stock Return Volatility* are positively loaded on the latent variable *LV Market Risk*. This means that higher values of *LV StandAlone Risk* and *LV Market Risk* indicate higher risk taking.

TABLE 3 Structural equation modelling (SEM) corporate governance and risk for US financial institutions

Panel A: Measurement model		
	LV StandAlone Risk	**LV Market Risk**
ROAV ←	1 (Constrained)	
Leverage ←	2.955*** (0.275)	
Z-score ←	−1.586*** (0.086)	
Idiosyncratic Risk ←		1 (Constrained)
Stock Return Volatility ←		1.200*** (0.027)
Panel B: Structural model		
	LV StandAlone Risk ←	**LV Market Risk ←**
Gov1	0.301*** (0.032)	0.514*** (0.037)
Gov2	−0.153*** (0.032)	−0.279*** (0.038)
Gov3	−0.500*** (0.033)	0.015 (0.036)
Gov4	−0.092*** (0.031)	−0.047 (0.036)
Gov5	−0.339*** (0.032)	0.005 (0.037)
Gov6	0.098*** (0.033)	−0.324*** (0.038)
Gov7	−0.253*** (0.032)	−0.223*** (0.037)
R^2	0.425	0.136
Observations	3116	3116

Note: This table represents the results of the SEM for the US sample to study the impact of principal component analysis (PCA) governance factors on stand-alone and market risk. Components of the PCA governance factors are listed in Table 1. Year and industry fixed effects are included in the models. Definitions and sources of all variables are detailed in Table A1. Standard errors are provided in parentheses. Variables with arrows pointing towards them are the endogenous variables *, **, and *** denote significance at 10%, 5%, and 1% respectively

Panel B of Table 3 shows the results of the structural model. The PCA governance factor *GOV1* is positively related to both stand-alone and market risk; a one-unit increase in *GOV1* causes the stand-alone risk to increase by 30.1% and the market risk to increase by 51.4%. This shows that the variables *CEO Cash*, *Executive Cash*, *CEO Stocks*, *Executive Stocks*, *Institutional Ownership*, *Board Stocks*, and *Compensation Advisor* positively and significantly affect risk taking, these results lead to partially accepting hypotheses 6 and 7. On the other hand, *Insider Ownership* has a negative effect which rejected the other part of hypothesis 6. The results reaffirm that equity-based compensation and institutional ownership positively affect risk. However, *GOV4* which includes executives and CEO's option awards has a significant negative effect on *StandAlone Risk*, which rejects the other part of hypothesis 7. In addition, the

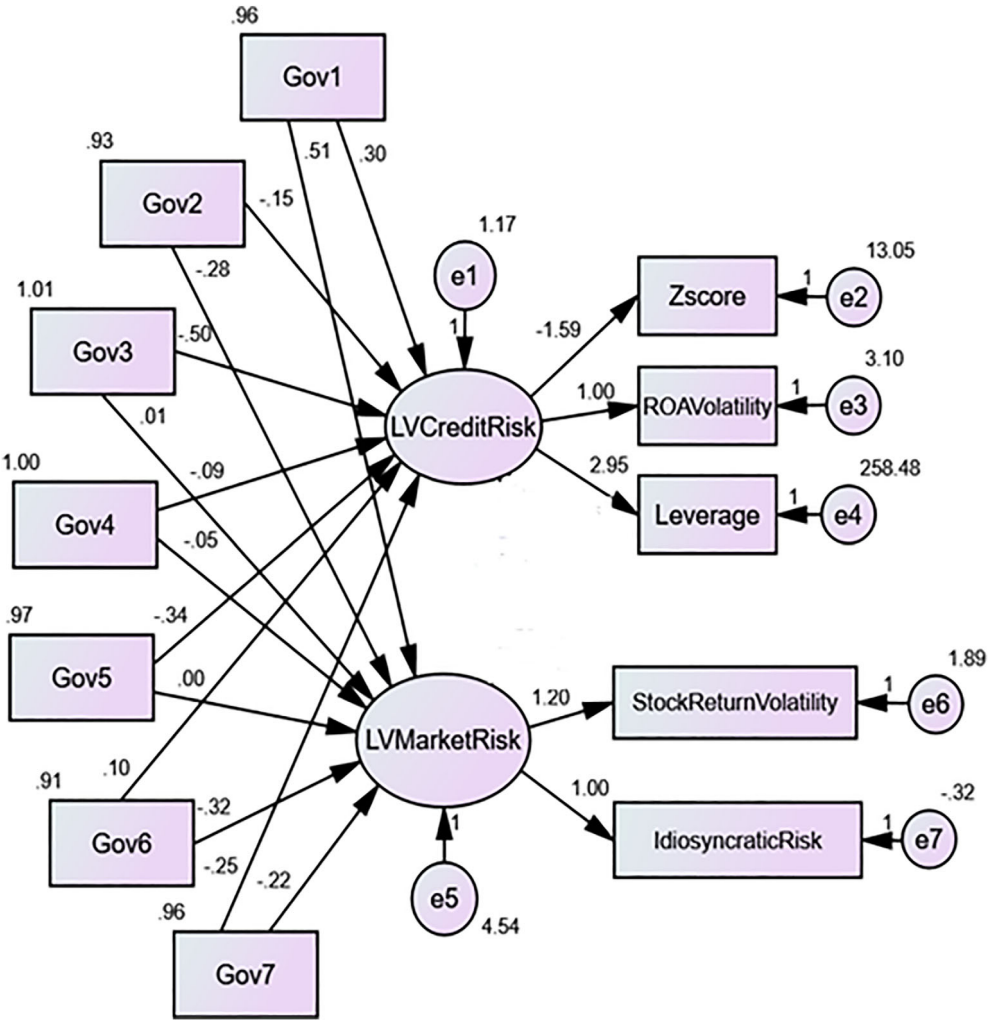

FIGURE 1 The structural equation modelling schematic. [Colour figure can be viewed at wileyonlinelibrary.com]

debt-based compensation (factors *GOV3* and *GOV5*) shows a negative effect on risk which supports hypothesis 8.

The factors *GOV2* and *GOV7*, which mostly include board characteristics, have a significant and negative effect on risk which means that these results reject hypothesis 2. However, *CEO Duality*, *Unequal Voting Rights* and *Board Attendance* have a positive effect on risk (due to their negative loadings on the factors). Therefore, the positive impact of *CEO Duality* supports hypothesis 4, while the positive effect of *Unequal Voting Rights* rejects hypothesis 5. However, the positive effect of *Unequal Voting Rights* on risk taking can be justified by the existence of controlling shareholders. The literature suggests that the presence of a controlling shareholder in a weak regulatory framework can lead to the abuse of other shareholders rights (Laeven & Levine, 2009; OECD, 2015).

Interestingly, the factor *GOV6* (which loads on *CPS* positively and *Gender Diversity* negatively) has a positive coefficient when regressed on stand-alone risk, but a negative coefficient when regressed on the market risk. The negative effect of *Gender Diversity* on risk taking accepts hypothesis 3. In addition, the positive effect of *CPS* and the negative effect of *Board Independence* both indicate that less independent directors take more risk. Another noticeable finding is the negative effect of *Board Average Age* on risk, which indicates that younger directors tend to take more risk.

Overall, the results support the idea that different CG variables have different impacts and not all of the CG variables positively affect risk. The predominant finding is that *Unequal Voting Rights*, *Institutional Shareholders* and all compensation elements (except debt-based) have a positive effect on risk, while most of the board characteristics and *Insider Ownership* have a negative effect on risk.

5 | ROBUSTNESS TEST

To test the robustness of the effect of PCA governance factors on risk taking, we estimate the following model:

TABLE 4 Linear regression

	Dependent variable: five measures of risk				
	ROAV	**Leverage**	***Z*-score**	**Stock return volatility**	**Idiosyncratic risk**
Gov1	0.533*** (0.068)	3.023*** (0.465)	−0.504*** (0.104)	−0.233** (0.103)	−0.126** (0.069)
Gov2	−0.041 (0.042)	−0.737*** (0.326)	−0.104 (0.080)	−0.147** (0.070)	−0.119*** (0.049)
Gov3	−0.019 (0.031)	−1.424*** (0.293)	0.319*** (0.083)	−0.184*** |(0.058)	−0.111*** (0.041)
Gov4	0.026 (0.032)	−0.796*** (0.296)	−0.023 (0.076)	−0.239*** (0.056)	−0.152*** (0.038)
Gov5	−0.116*** (0.035)	−0.737*** (0.312)	0.741*** (0.074)	−0.175*** (0.063)	−0.084** (0.044)
Gov6	−0.013 (0.043)	0.024 (0.342)	0.106 (0.082)	−0.071 (0.054)	−0.072** (0.039)
Gov7	−0.122*** (0.031)	−1.484*** (0.271)	0.112* (0.069)	−0.075 (0.056)	−0.113*** (0.041)
Firm size	−0.850*** (0.087)	−1.312** (0.639)	0.802*** (0.150)	1.723*** (0.070)	1.176*** (0.102)
M-to-B	0.353*** (0.065)	−2.229*** (0.453)	0.255*** (0.067)	0.546*** (7.543)	0.379*** (0.046)
ROE	−0.19** (0.009)	0.124** (0.056)	0.094*** (0.009)	0.027*** (0.564)	0.025*** (0.004)
Capital ratio	5.398*** (0.504)	−9.876*** (2.997)	−0.523 (0.645)	3.259*** (6.788)	2.145*** (0.396)
Observations	3116	3116	3116	3116	3116
R^2	0.538	0.327	0.212	0.285	0.316

Note: This table represents the results of regressing five risk measurements (ROAV, leverage, *Z*-score, stock return volatility and idiosyncratic risk) on principal component analysis (PCA) governance factors (Gov1, Gov2, Gov3, Gov4, Gov5, Gov6 and Gov7) for the US sample. Components of the PCA governance factors are listed in Table 1. Definitions and sources of all variables are detailed in Table 1. Year and industry fixed effects are included in all regressions. t-statistics based on robust standard errors are provided in parentheses. *, **, and *** denote significance at 10%, 5%, and 1% respectively

$$Risk_{i,t} = \beta_0 + \beta_1 Gov1_{i,t-1} + \beta_2 Gov2_{i,t-1} + \beta_3 Gov3_{i,t-1} + \beta_4 Gov4_{i,t-1} + \beta_5 Gov5_{i,t-1} + \beta_6 Gov6_{i,t-1} + \beta_7 Gov7_{i,t-1} + \beta_8 Control_{i,t-1} + \gamma_t + \delta_i + \varepsilon_{i,t}, \quad (11)$$

where $Risk_{i,t}$ is one risk measurement for the company i in the year t out of the five different measurements of risk. In all risk measurements, a higher value indicates a higher risk, except for the *Z*-score, where higher values indicate lower risk. $Gov1_{i,t-1}$ to $Gov7_{i,t-1}$ are the PCA governance factors. $Control_{i,t-1}$ is a set of four variables that control for firm level. γ_t is the year fixed effect and δ_i is the industry fixed effect. $\varepsilon_{i,t}$ is the residual. The descriptions and definitions of all variables are detailed in the variables list. As in the SEM analysis, the lagged independent and control variables, and the year and industry fixed effect help in alleviating endogeneity.

Table 4 provides the results of estimating Equation (11) to study the effect of PCA governance factors on the five different risk measurements. The linear regression results of *GOV2*, *GOV4*, and *GOV7* are consistent with the SEM results. However, *GOV1* has a negative effect on market risk measurements in the linear regression, while positive in the SEM. Also, GOV6 has no significant coefficients for most of the regressions which differs from the SEM results, except for *Idiosyncratic Risk* with a negative coefficient that is consistent with the SEM. Finally, the coefficients of *GOV3* and *GOV5* show more significant and negative results, confirming the findings of the SEM. In terms of the control variables, *Firm Size* has a negative and significant effect on risk proxied by *ROAV* and *Z-score*, which suggests that bigger institutions have more stand-alone risk. The positive effect of firm size on risk taking confirms the findings of Anginer et al. (2018) that big banks take higher risk due to their too big to fail status. Generally, higher market to book ratio, return on equity and capital ratio result in higher risk.

We also run restricted models in which each independent variable is the only regressor. The results of the restricted models confirm the results of the unrestricted models reported in Table 4. However, the restricted models remove the ambiguity in the factors *GOV1* and *GOV6*. The restricted models show that *GOV1* has a positive effect on stand-alone risk and a negative effect on market risk. In addition, *GOV6* shows more significance in the restricted models with a positive effect on stand-alone risk and a negative one on market risk, consistent with the results of the SEM. Overall, the linear regressions support and complement the results of SEM, which supports the usage of SEM to study the effect of PCA on various risk measurements in one model.

In addition, we run another robustness test by extending the US sample to an international sample that includes 30 countries for the period of 2011 to 2017. The number of observations has increased from 3116 to 4633

TABLE 5 ISS governance score versus ISS sub-scores (US)

	Dependent variable: five measures of risk				
	ROAV	**Leverage**	***Z*-score**	**Stock return volatility**	**Idiosyncratic risk**
Panel A: ISS governance score					
ISS governance score	0.043*** (0.018)	0.271** (0.130)	−0.043* (0.031)	0.090*** (0.036)	0.092*** (0.027)
Firm size	−0.775*** (0.096)	−3.743*** (0.565)	0.471*** (0.124)	2.021*** (0.222)	1.462*** (0.153)
M-to-B	0.612*** (0.068)	−2.363*** (0.360)	−0.087** (0.044)	0.639*** (0.106)	0.473*** (0.074)
ROE	−0.075*** (0.011)	0.042 (0.067)	0.142*** (0.009)	0.031** (0.015)	0.039*** (0.011)
Capital ratio	5.598*** (0.617)	−41.916*** (3.229)	−0.530 (0.680)	5.074*** (0.970)	3.751*** (0.722)
Observations	2504	2504	2504	2504	2504
R^2	0.469	0.428	0.238	0.187	0.203
Panel B: ISS governance sub-scores					
ISS board	−0.063*** (0.020)	−0.380*** (0.128)	−0.014 (0.029)	0.056 (0.038)	0.021 (0.028)
ISS shareholders	−0.031** (0.016)	−0.142 (0.125)	0.078*** (0.030)	0.071*** (0.028)	0.061*** (0.021)
ISS compensation	0.072*** (0.021)	−0.161 (0.125)	−0.048** (0.028)	0.043 (0.035)	0.068*** (0.025)
ISS audit	0.142*** (0.030)	0.180 (0.178)	−0.149*** (0.031)	0.002 (0.034)	0.003 (0.028)
Firm size	−0.824*** (0.094)	−4.000*** (0.574)	0.505*** (0.125)	2.068*** (0.230)	1.486*** (0.159)
M-to-B	0.581*** (0.068)	−2.435*** (0.367)	−0.069* (0.045)	0.649*** (0.107)	0.471*** (0.075)
ROE	−0.073*** (0.011)	0.047 (0.067)	0.140*** (0.009)	0.030** (0.015)	0.039*** (0.011)
Capital ratio	5.957*** (0.608)	−41.584*** (3.273)	−0.736 (0.681)	5.087*** (0.973)	3.845*** (0.725)
Observations	2504	2504	2504	2504	2504
R^2	0.485	0.430	0.248	0.189	0.204

Note: This table represents the results of regressing the five risk measurements on corporate governance overall score (*ISS governance score*) and sub-scores (*ISS Board*, *ISS shareholders*, *ISS compensation*, and *ISS audit*) as developed by ISS for the US sample. Definitions and sources of all variables are detailed in Table A1. Year and industry fixed effects are included in all regressions. *t* statistics based on robust standard errors are provided in parentheses. *, **, and *** denote significance at 10%, 5%, and 1% respectively.

firm-year observations. Extending the sample to other countries provides a larger sample that will serve as a robustness test and test the generalizability of the results to a global context following Anginer et al. (2018) and John et al. (2008). However, due to the lower data availability, the number of CG characteristics included in the analysis decreased from 23 to 10 variables which are *Board Size*, *Board Independence*, *Board Meetings*, *Gender Diversity*, *Board Duration*, *CEO Duality*, *Compensation Advisor*, *Unequal Voting Rights*, *Institutional Ownership* and *Insider Ownership*.

The PCA analysis of this sample results in four factors that accounted for 62.18% of the total variance. The SEM findings confirm the results using the US only sample and provide firm evidence of the positive effect of *Unequal Voting Rights* and *Compensation Advisor*, and the negative effect of *Board Independence* and *Board size* on risk taking. In addition, the results of the linear regression using this extended sample are consistent with the previous findings.

6 | ADDITIONAL ANALYSIS

As an additional analysis, we replace the PCA factors used in the previous models with Governance scores created by ISS. We run the model twice, once using the main governance score created, and another using the four sub-scores (Board, Audit, Shareholders and Compensation). The ISS governance scores are for the period 2013–2018 with 2504 observations.

To test the correlation between CG variables represented as ISS governance score and risk taking, we estimate the following model:

$$Risk_{i,t} = \beta_0 + \beta_1 ISS\ Governance\ Score_{i,t} + \beta_2 Control_{i,t} + \gamma_t + \delta_i + \varepsilon_{i,t}, \quad (12)$$

Where $ISS\ Governance\ Score_{i,t}$ is the governance score created by the ISS as reported in Bloomberg.

TABLE 6 Summary of results.

Variable	Significant results[a] A	B	Results from prior literature
Panel A: corporate governance variables			
Board independence	Negative	Negative	Positive (Anginer et al., 2018; Ho et al., 2013; Lu & Wang, 2018; Nakano & Nguyen, 2012; Sheikh, 2019)
Board meetings	Negative	Negative	Has not been investigated
Board size	Negative	Negative	Negative (Nakano & Nguyen, 2012; Wang & Hsu, 2013; Wu, 2016)
Board meeting attendance	Positive	Positive	Has not been investigated
Board Duration	Negative	Negative	Has not been investigated
Board Average Age	Negative	Negative	Negative (Berger et al., 2014)
CEO duality	Positive	Positive	Positive (Adams et al., 2005; Deyoung et al., 2013; Ho et al., 2013; Sheikh, 2019; Switzer et al., 2018; Wu, 2016)
Gender Diversity	Negative	Positive	Negative (Berger et al., 2014; Wu, 2016)
Unequal Voting Rights	Positive	Positive	Negative (Kieschnick & Moussawi, 2018; Mishra, 2011)
Institutional Ownership	Positive	Positive	Positive (Erkens et al., 2012; Hutchinson et al., 2015) Negative (Nakano & Nguyen, 2012; Switzer et al., 2018)
Insider ownership	Negative	Negative	Positive (Laeven & Levine, 2009; Switzer et al., 2018)
CPS	Positive	Negative	Sheikh (2019)
Compensation Advisor	Positive	Positive	Has not been investigated
Board Stocks	Positive	Positive	Positive (Anginer et al., 2018; Ertugrul & Hegde, 2008)
CEO stocks	Positive	Positive	Positive (Cain & McKeon, 2016; Deyoung et al., 2013; Guay, 1999; Nakano & Nguyen, 2012)
Executive stocks	Positive	Positive	Positive (Deyoung et al., 2013; Guay, 1999; Nakano & Nguyen, 2012)
CEO options	Negative	Negative	Positive (Cain & McKeon, 2016; Deyoung et al., 2013; Guay, 1999)
Executive options	Negative	Negative	Positive (Deyoung et al., 2013; Guay, 1999)
CEO Cash	Positive	Positive	Positive (Cain & McKeon, 2016; Deyoung et al., 2013; Guay, 1999; Jensen & Meckling, 1976)
Executive cash	Positive	Positive	Positive (Deyoung et al., 2013; Guay, 1999; Jensen & Meckling, 1976)
CEO Deferred	Negative	Negative	Negative (Cassell et al., 2012; Edmans & Liu, 2011; Jensen & Meckling, 1976; Srivastav & Hagendorff, 2016)
Executive deferred	Negative	Negative	Negative (Cassell et al., 2012; Edmans & Liu, 2011; Jensen & Meckling, 1976; Srivastav & Hagendorff, 2016)
CEO non-equity	Negative	Negative	Has not been investigated (Edmans et al., 2017)
Executive non-equity	Negative	Negative	Has not been investigated (Edmans et al., 2017)
Panel B: ISS Governance Score and Sub-Scores			
ISS Governance Score	Positive	Positive	Positive (Anginer et al., 2018; Ferreira & Laux, 2007; John et al., 2008; Laeven & Levine, 2009)
ISS Board	Negative	Negative	Positive (Anginer et al., 2018; Lu & Wang, 2018; Wu, 2016)
ISS Shareholders	Negative	Positive	Positive (Anginer et al., 2018; Ferreira & Laux, 2007; John et al., 2008; Laeven & Levine, 2009)
ISS Compensation	Positive	Positive	Positive (Cain & McKeon, 2016; Deyoung et al., 2013; Ertugrul & Hegde, 2008; Guay, 1999; Jensen & Meckling, 1976)
ISS Audit	Positive	Positive	Positive (Anginer et al., 2018)

[a]The columns represent the effect of corporate governance on (A) Stand-alone risk for the US sample. (B) Market risk for the US sample.

Next, we replace the *ISS Governance Score* with the four sub-scores, by estimating the following model using univariate general linear regression:

$$Risk_{i,t} = \beta_0 + \beta_1 ISS\,Board_{i,t} + \beta_2 ISS\,Shareholders_{i,t} + \beta_3 ISS\,Audit_{i,t} + \beta_4 ISS\,Compensation_{i,t} + \beta_5 Control_{i,t} + \gamma_t + \delta_i + \varepsilon_{i,t}, \quad (13)$$

where the independent variables are the governance sub-scores created by ISS, namely $ISS\,Board_{i,t}$, which accounts for board characteristics, $ISS\,Shareholders_{i,t}$, which accounts for shareholders' rights, $ISS\,Audit_{i,t}$, which accounts for Auditing practices and $ISS\,Compensation_{i,t}$, which accounts for compensation and remuneration.

Table 5 shows the results of regressing *ISS Governance Score* and the ISS sub-scores on risk taking. Unlike the main analysis that did not include a variable showing the main score of governance, these results will allow addressing the research hypothesis 1. Panel A shows the positive and significant effect of *ISS Governance Score* on risk, which confirms that shareholder-friendly CG has a positive effect on risk, which accepted the first research hypothesis. However, Panel B shows that, when CG variables are studied separately, not all have a positive effect on risk. *ISS Board* is negative but not always significant and *ISS Shareholders* has a negative effect on stand-alone risk but a positive effect on market risk. Finally, both *ISS Compensation* and *ISS Audit* have a positive effect on risk, which suggests that the positive effect of CG on risk is mainly driven by compensation characteristics and auditing practices.

7 | CONCLUSION

This study contributes to the broader literature on the effect of CG on risk by showing how CG characteristics have different effects on risk taking. Findings confirm that CG as a whole positively affects risk. However, there are certain characteristics that have a negative effect, but their effect is offset by other, positive, characteristics. The study reveals that the positive effect of CG on risk is mainly driven by executive compensation structures and auditing practices. However, insider ownership, debt-based compensation and board characteristics including board independence and size have negative effects.

These results are also supported by the robustness test where we use the governance scores and sub-scores developed by ISS. ISS governance scores show that CG as a whole has a positive effect on risk, but some of the sub-scores have a negative effect, including board characteristics and shareholders' rights.

Table 6 provides the summary and the final view of the results for all of the CG variables included in this study and the ISS scores. This table highlights the benefit of using PCA analysis as a replacement for indices. The results using ISS scores support the results using the PCA factors. However, the invalidity of using indices is highlighted when comparing the sum effect of one group to the individual effects of each variable within the same group. For example, the ISS board score shows that board characteristics have a negative impact on risk taking, but when compared to the induvial effects shown in by the PCA analysis, it can be noted that there are some variables related to the board that have a positive effect includes the board meetings.

The findings of our study highlight the importance of a granular study of CG rather than a broad overview using a single index. For example, the negative effect of *Board Independence* on risk taking confirms the importance of requiring the majority of the board to be independent, and that more board independence does not cause excessive risk taking, thus contributing to the shareholder value maximization literature (Anginer et al., 2018; Ferreira & Laux, 2007; Ferris et al., 2017; John et al., 2008; Laeven & Levine, 2009; Saunders et al., 1990).

7.1 | Research implications

Finally, the implications of these findings benefit managers and regulators as well as shareholders. Examining the effect of CG on risk-taking can offer useful guidelines for policymakers, where our results suggest that CG frameworks should be developed by fully considering that not all aspects of CG behave similarly.

Our results show that unequal voting rights, institutional shareholders and non-equity-based compensation have a positive effect on risk, while most of board characteristics and insider ownership have a negative effect on risk. These findings provide an insight into the significant characteristics of CG and their different effects on risk taking.

For example, when designing a CG framework to address the excessive risk taking in financial institutions, the equity compensation requirement should be reduced (reflecting less shareholder friendly principles), and board independence requirements should be strengthened (reflecting more shareholder friendly principles). Although these principles have different directions, they all aim to minimize risk taking. In other words, granular analysis of CG characteristics matters more than it may initially seem.

7.2 | Research limitations

The first limitation was the data availability which results in having smaller samples than originally planned. The

lack of data availability also resulted in eliminating the international sample and eliminating several CG variables.

Regarding the methodologies used, the main limitation of the PCA analysis is that it created governance factors that did not include variables from similar groups of CG. Therefore, it was not possible to name these factors based on the characteristics included. In addition, the Bloomberg database provided the ISS scores without details of their constructions, which would have been of benefit to the analysis.

7.3 | Further research areas

There are many opportunities to direct this study for the future. First, creating PCA factors that have similar CG variables which will enable naming them according to their suitable group which will ease the difficult interpretation of the results caused by the anonymous naming. This will add a benefit to the generally used indices, which is the individual interpretation of each variable within each group. Finally, applying these studies to an international sample will increase the generalisability of the results.

In addition, extending the CG variables to cover more aspects would be a great benefit. Variables that could be incorporated include board committees, their independence, and the remuneration of directors sitting on these committees. Also, board diversity includes several aspects that could be included in this study other than gender and age which include ethnicity, educational background, and work experience.

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DATA AVAILABILITY STATEMENT

The data that support the findings of this study are openly available in the Bloomberg database.

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ENDNOTE

[i] To test the reliability of using PCA as a replacement for indexing for corporate governance variables, we used the Kaiser-Meyer-Olkin measure of sampling adequacy, which showed a score of 0.712 with high significance. These results confirmed the reliability of using PCA for the corporate governance variables. We also ran a correlation matrix for both the corporate governance variables and the PCA governance factors. The corporate governance variables showed multicollinearity while the PCA governance factors showed no correlation, which further supports the usage of PCA.

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APPENDIX A

TABLE A1 Variables list.

Variable	Definition	Database
Risk measurement		
Z-score	Return on assets plus equity to asset ratio divided by the standard deviation of the return on assets (High value = low risk).	Authors' Calculations
ROAV	The standard deviation of the returns on asset constructed for each year.	Authors' Calculations
Leverage	The ratio of total debt to total assets.	Bloomberg
Stock return volatility	Annualized standard deviation of daily stock returns.	Authors' Calculations
Idiosyncratic risk	The standard deviation of the residuals derived from regressing daily stock return on market return in each year.	Authors' Calculations
LV stand-alone risk	A latent variable that represents the stand-alone risk generated from the measurement model based on three risk measurements; *ROAV*, *Leverage* and *Z-score*.	Structural Equational Model
LV market risk	A latent variable that represents market risk generated from the measurement model based on two risk measurements; *Stock Return Volatility* and *Idiosyncratic Risk*.	Structural Equational Model
Corporate governance		
Board size	Number of directors on the company's board.	Bloomberg
Board independence	Independent directors as a percentage of total board membership.	Bloomberg
Board meetings	Total number of corporate board meetings held in the past year.	Bloomberg
Board attendance	Percentage of members in attendance at board meetings during the period.	Bloomberg
Gender diversity	Percentage of women on the board of directors.	Bloomberg
Board average age	Average age of the members of the board.	Bloomberg
Board duration	Length of a board members' term, in years.	Bloomberg
CEO duality	Indicates whether the company's Chief Executive Officer is currently also chairperson of the Board. Takes the value of 0 when the CEO and chairperson positions are separated and 1 otherwise.	Bloomberg
CPS	Bebchuk et al. (2011) CEO Pay Slice calculated as the ratio of the CEO total compensation to Executives' total compensation.	Authors' Calculations
CEO stocks	The log of the total amount of stock the company awarded to the Chief Executive Officer.	Bloomberg
Executive stocks	The log of the total amount of stock the company awarded to the executives.	Bloomberg
CEO options	The log of the total amount of options the company awarded to the Chief Executive Officer.	Bloomberg
Executive options	The log of the total amount of options the company awarded to the executives.	Bloomberg
CEO deferred	The log of the total amount of pension and nonqualified deferred pension given to the Chief Executive Officer.	Bloomberg

TABLE A1 (Continued)

Variable	Definition	Database
Executive deferred	The log of the total amount of pension and nonqualified deferred pension given to the executives.	Bloomberg
CEO non-equity incentives	The log of the total amount of non-equity incentives the company awarded to the Chief Executive Officer.	Bloomberg
Executive non-equity incentives	The log of the total amount of non-equity incentives the company awarded to the executives.	Bloomberg
Board stocks	Stock awards given to directors compared to total director compensation as a percentage.	Bloomberg
CEO cash	The log of the total salary and bonus amount the company paid to the Chief Executive Officer.	Bloomberg
Executive cash	The log of the total salary and bonus amount the company paid to the executives.	Bloomberg
Compensation advisor	Takes the value of 1 if the company appoints outside executive compensation advisors, and 0 otherwise.	Bloomberg
Unequal voting rights	Indicates whether the company has unequal/restricted voting rights between common share classes (single, dual or multiple classes of shares). Takes the value of 1 if voting rights are unequal and 0 otherwise.	Bloomberg
Institutional ownership	Percentage of outstanding shares held by institutions.	Bloomberg
Insider ownership	Percentage of outstanding shares currently held by insiders.	Bloomberg
ISS governance score	Overall score assigned by ISS to the company's governance practices. The score ranges from 1 for best to 10 for worst.	Bloomberg
ISS board	Score assigned by ISS to the structure of the company's board of directors. The score ranges from 1 to 10 and is a component of ISS's Governance Score.	Bloomberg
ISS shareholders	Score assigned by ISS to shareholder rights at the company. The score ranges from 1 to 10 and is a component of ISS's Governance Score.	Bloomberg
ISS audit	Score assigned by ISS to the company's audit process. The score ranges from 1 to 10 and is a component of ISS's Governance Score.	Bloomberg
ISS compensation	Score assigned by ISS to the company's compensation practices. The score ranges from 1 to 10 and is a component of ISS's Governance Score.	Bloomberg
Firm control variables		
Firm size	the log of total assets in billion US dollars.	Bloomberg
Market to book	Market capitalisation to the book value of equity.	Authors' Calculations
ROE	Net income to total equity.	Bloomberg
Capital ratio	Book value of equity to total book value of assets.	Authors' calculation

APPENDIX B

TABLE B1 Prior literature on measuring risk taking.

Papers	Variable	Relationship to corporate governance	Corporate governance	Sector	Country	Period
Laeven and Levine (2009)	*Z*-score	Greater cash flow rights by a large owner is associated with greater risk.	Ownership	Banks	48 countries	1996–2001
	ROA volatility					
	Equity volatility					
	Earnings volatility	The results are somewhat weaker. But still negatively and significantly related to ownership even with this measure that can be subject to substantial manipulation by banks.				
Anginer et al. (2018)	Distance to default	All six measurements of risk have a positive relationship with shareholder friendly CG, and more positive relationship in banks than non-financial firms.	CG Index measuring shareholder protection	Banks and non-financial firms	US and 22 counties	1990–2014
	Leverage	Is the most significant.				
	Asset volatility	Least impact.				
	Marginal expected shortfall	Positive relationship.				
	Systemic risk	Positive relationship.				
	Conditional value at risk	Least impact.				
John et al. (2008)	Earnings volatility	Results show a positive relationship between risk taking and all three shareholder friendly CG variables.	Investor protections indicators (rule of law, anti-directors right index, disclosure)	Manufacturing Industry (SIC 2000–3999)	39 countries	1992–2002
Lu and Wang (2018)	Research and development expenditure	Board independence is positively and significantly related to managerial risk taking, which means board independence helps to combat managerial conservatism.	Board independence	Listed firms	US	1996–2007

TABLE B1 (Continued)

Papers	Variable	Relationship to corporate governance	Corporate governance	Sector	Country	Period
Berger et al. (2016)	Nonperforming loans	larger shareholdings of lower-level management and non-CEO higher- level management significantly increase banks' risk taking. However, the shareholdings of the CEO appear to have no direct impact on a bank's risk taking. NPL is mostly related to outside directors' options.	Bank shares and options ownership, compensation, and management structure	Commercial banks	US	2007–2010
	Z-score	Mostly related to outside directors' options.				
	Non-interest income	Most significance within the influence of lower management and non-CEO ownership effect on risk taking.				
	Capital ratio	Little influence.				
	ROA	Highest ratios indicating that his is the primary channel of risk taking by lower management and non-CEO.				
Erkens et al. (2012)	Expected default frequency	Greater institutional is related to more risk taking, but board independence is not related to risk taking.	Board independence, institutional shareholders, and large shareholder	Financial institutions	30 countries	2007–2008
	Stock return volatility	Less significance.				
Sheikh (2019)	Stock return volatility Idiosyncratic risk	CEO power is positively associated with risk.	CEO power (CPS, CEO duality, board independence, CEO tenure, founding family), Gompers et al. (2003) index	Non-Financial firms	US	1992–2015

(Continues)

TABLE B1 (Continued)

Papers	Variable	Relationship to corporate governance	Corporate governance	Sector	Country	Period
Pan et al. (2017)	CDS spread Loan spread Bond yield spread	CEO tenure is negatively related to default risk. CEO turnover is positively related to risk.	CEO turnover and tenure	Fama–French 48 industry classification	US	2001–2009
Ferreira and Laux (2007)	Idiosyncratic volatility Relative idiosyncratic volatility Logistic idiosyncratic volatility	Strong negative relationship.	Antitakeover provisions index. And shareholder friendly G-index as used in Gompers et al. (2003)	Non-financial firms		1990–2001
Ferris et al., 2017	Stock return volatility Volatility ROA Volatility ROE Research and development expenditures corporate diversification Leverage Working capital	Positive and significant relationship. Negative and significant relation.	CEO social capital		Global	1999–2011
Kim and Lu (2011)	Research and development investments	In weak external CG, CEO ownership is significantly and significantly related to risk.	CEO ownership and external CG			1992–2006
Calomiris and Carlson (2016)	Real estate loans to total loans Estimated losses to assets Equity to asset ratio Cash to assets ratio	Managerial ownership is negatively related to estate loans, but positively related to G score. Negative and significant relationship with G score. Most significant negative relationship with managerial ownership. Managerial ownership is negatively related to default risk, as they prefer to use cash instead of equity.	Managerial ownership, board meetings, board outsiders, managerial turnover, G score	Banks	US	1892–1893

TABLE B1 (Continued)

Papers	Variable	Relationship to corporate governance	Corporate governance	Sector	Country	Period
Wu (2016)	Idiosyncratic risk	More volatility is related to higher probability of bankruptcy.	Gender diversity, CEO power (CEO duality and ownership), CEO tenure, turnover and age, audit committee independence, institutional shareholding, insider shareholding	Non-financial firms	US	1996–2006
Hutchinson et al. (2015)	Stock deviation Risk management *Z*-score	Institutional shareholders are positively related to risk.	Institutional shareholders	ASX listed companies	Australia	2006–2008
Sharma et al. (2008)	Inherent risk Control environment risk	When auditors perceive stronger governance, they lower their assessment of control environment risk.	Weak, moderate, or strong CG with respect to board and audit committee characteristics	Audit managers	Singapore	2002
Christy et al. (2013)	Volatility of stock return	Shareholders' assessment of risk is lower for large firms whose boards are more independent and educated, and in small companies it is not related to board independence but is greater in qualified board.	Board independence, board qualification	ASX listed companies	Australia	2001–2007
Saunders et al. (1990)	Total return risk Non-systematic risk Market risk Interest rate risk	Stockholder controlled banks is positively related to risk taking in a deregulated environment.	Ownership	Banks		1979–1082
Deyoung et al. (2013)	Total risk Systematic risk Idiosyncratic risk	CEO pay-risk sensitivity is positively and significantly related to risk taking.	CEO and executive compensation	Banks	US	1994–2006
	Total return volatility					1991–1992

(Continues)

TABLE B1 (Continued)

Papers	Variable	Relationship to corporate governance	Corporate governance	Sector	Country	Period
Cain and McKeon (2016)		Corporate risk behaviour is significantly and positively related to risk taking.	CEO risk taking measured by aircraft piloting to test risk behaviour			
Cassell et al. (2012)	Volatility of future stock return	Negative relationship, more CEO deferred compensation is associated with less risk taking.	CEO inside debt (deferred compensation)	Many industries	US	2006–2008
	Idiosyncratic risk	Negative relationship.				
	Diversification	Positive relationship.				
	Research and development expenditure	Negative relationship.				
	Total book leverage	Negative relationship.				
	Working capital	Positive relationship.				
Guay (1999)	Sensitivity of wealth to equity risk	Stock based compensation is positively related to risk taking.	CEO wealth (stock options in compensation, and salary and bonus)	Non-financial Firms	US	1988–1993
	Stock return volatility	Same results.				
Nakano and Nguyen (2012)	ROA volatility Tobin's Q Sock return volatility	Firms with larger boards exhibit lower performance volatility.	Board size, inside directors, executives and directors' stocks, institutional investors	Non-Financial Firms	Japan	2003–2007
Mishra (2011)	ROA volatility	The presence of dominant shareholder is associated with lower risk, while the voting rights of multiple large shareholders is associated with higher risk.	Dominant Shareholders, multiple large shareholders, voting rights	Non-financial firms	Nine East Asia countries	1996–2005
Ho et al. (2013)	Volatility of ROA Underwriting risk Investment risk Leverage risk	More board independence and CEO duality lead to higher risk. The impact of board size on different risk-taking measures varies.	Board size, CEO duality, board independence	Property causality insurance industry	US	1996–2007

TABLE B1 (Continued)

Papers	Variable	Relationship to corporate governance	Corporate governance	Sector	Country	Period
Akbar et al. (2017)	Idiosyncratic risk *Z*-score	Board independence and CEO duality have a negative impact on risk, board size has no impact on size.	Board size, independence and CEO duality	Financial sector	UK	2003–2012
Switzer et al. (2018)	Credit default swap spreads Default probability	Higher institutional ownership and greater board independence are shown to reduce firms' default probabilities. But, insider ownership, CEO duality, and board size are positively related to default probabilities.	Institutional ownership, insider ownership, board independence, board size, and CEO duality.	Financial firms	28 countries	2010–2012

APPENDIX C

TABLE C1 Pearson correlations.

Panel A: PCA factors

	Gov1	Gov2	Gov3	Gov4	Gov5	Gov6	Gov7	Firm size	M/B	ROE	Cap. ratio
Gov1	1	−0.012	0.133**	0.184**	0.288**	−0.225**	−0.138**	0.661**	0.170**	0.144**	0.133**
Gov2	−0.012	1	0.060**	0.071**	0.149**	0.055**	0.073**	0.022	−0.142**	−0.127**	−0.339**
Gov3	0.133**	0.060**	1	0.143**	0.069**	−0.144**	0.049**	0.415**	−0.146**	−0.040*	−0.272**
Gov4	0.184**	0.071**	0.143**	1	0.107**	−0.025	−0.111**	0.251**	0.045**	0.008	−0.012
Gov5	0.288**	0.149**	0.069**	0.107**	1	−0.102**	−0.057**	0.258**	0.055**	0.103**	−0.005
Gov6	−0.225**	0.055**	−0.144**	−0.025	−0.102**	1	−0.001	−0.409**	−0.081**	−0.065**	0.029
Gov7	−0.138**	0.073**	0.049**	−0.111**	−0.057**	−0.001	1	−0.041*	−0.146**	−0.121**	−0.200**
Firm Size	0.661**	0.022	0.415**	0.251**	0.258**	−0.409**	−0.041*	1	−0.147**	−0.009	−0.289**
M/B	0.170**	−0.142**	−0.146**	0.045**	0.055**	−0.081**	−0.146**	−0.147**	1	0.494**	0.398**
ROE	0.144**	−0.127**	−0.040*	0.008	0.103**	−0.065**	−0.121**	−0.009	0.494**	1	0.221**
Cap. Ratio	0.133**	−0.339**	−0.272**	−0.012	−0.005	0.029	−0.200**	−0.289**	0.398**	0.221**	1

Panel B: ISS governance score and sub-scores

	ISS Score	ISS Board	ISS Shareholders	ISS Audit	ISS Comp.	Firm Size	M/B	ROE	Cap. Ratio
ISS score	1	0.513**	0.588**	0.232**	0.645**	−0.184**	−0.050*	−0.015	0.021
ISS board	0.513**	1	0.116**	0.079**	0.217**	−0.243**	−0.056*	−0.025	0.163**
ISS shareholder	0.588**	0.116**	1	−0.053*	0.024	−0.149**	−0.080**	−0.048*	−0.003
ISS audit	0.232**	0.079**	−0.053*	1	0.137**	0.019	−0.006	−0.015	−0.056*
ISS comp.	0.645**	0.217**	0.024	0.137**	1	−0.082**	0.031	0.040	−0.066**
Firm size	−0.184**	−0.243**	−0.149**	0.019	−0.082**	1	−0.227**	−0.062**	−0.492**
M/B	−0.050*	−0.056*	−0.080**	−0.006	0.031	−0.227**	1	0.561**	0.304**
ROE	−0.015	−0.025	−0.048*	−0.015	0.040	−0.062**	0.561**	1	0.197**
Capital ratio	0.021	0.163**	−0.003	−0.056*	−0.066**	−0.492**	0.304**	0.197**	1

Note: *, **, and *** denote significance at 10%, 5%, and 1%, respectively.